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THE DEVONIAN SECTION ON TEN MILE CREEK, LUCAS COUNTY, OHIO.

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The Devonian formations of Ohio are fairly well known in those portions of the state where they constitute the bed rock. This is especially true in the central strip of outcrop where the shales and limestones of this System sometimes form cliffs fifty to seventy-five feet high. In northwestern Ohio, however, the land lies but little above drainiage level and the covering of drift is frequently so deep that the streams do not cut through it. Hence our knowledge of most of the Devonian formations in this portion of the state is limited to a few outcrops with incomplete and more or less unsatisfactory sections.

In this northwestern area, the Columbus limestone[1] is extensively quarried at White House and occasionally, on a much smaller scale, at a number of other places. The Delaware limestone forms only occasional and meagre outcrops, while the Olentangy shale is either entirely wanting or is inseparable from the other Erian formation. The Ohio shale outcrops at several

(1) Ohio Classification of the Devonian and extreme upper portion of the Silurian as approved by Dr. Charles S. Prosser.

Devonian	Chautauquan and Senecan	Ohio shale	Cleveland sh. Chagrin form. Huron sh.
	Erian		Olentangy shale Delaware limestone
	Ulsterian		Columbus limestone
	UNCONFORMITY		
Silurian	Cayugan	Monroe form.	Lucas ls. Sylvania ss. Tymochtee form.

places along Auglaize and Maumee Rivers and a calcareous layer occurring near the base of the formation was formerly used in the manufacture of cement at Defiance.

These Devonian outcrops received some attention from the members of the State Geological Survey during the seventies and a report of their work is given in the publications of the Survey at that time. A section which escaped notice, probably because it was then largely covered, is to be found along Ten Mile Creek. This stream flows across the northen portion of Lucas County and empties into Maumee Bay at the state line. Near Silica, eight miles west of Toledo, the creek crosses a slightly drift covered limestone ridge which extends southward from Michigan into Oiho. During the summer of 1906, the channel was artificially deepened and at that time an excellent outcrop of rock was laid bare. The section is similar to that discussed by G. K. Gilbert[2] except that it includes more of the Devonian. It is to these upper strata of the following section that particular attention is called since they rarely outcrop in northwestern Ohio.

SECTION ON TEN MILE CREEK.

DEVONIAN

Delaware limestone (*Traverse*).

14.	Massive compact bluish drab limestone containing iron pyrites, traces of petroleum and a few fossils	10′
13.	Thin unevenly bedded blue limestone with several layers of white chert, both fossiliferous	3′
12.	Blue shale and soft shaly limestone containing much iron pyrites and quite fossiliferous	2′ 6″
11.	Bluish gray limestone alternating with layers of fossiliferous white chert	3′ 6″
10.	A rather compact drab limestone with many fossils, occurring as casts, and a considerable amount of fossiliferous white chert	2′
9.	Bluish gray shaly limestone with irregular layers of fossiliferous white chert. At places much of this zone becomes a mass of corals	2′
8.	Rather thick and some thin layers of blue limestone inter-bedded with soft blue shaly layers	4′
7.	Covered interval, probably in large part shaly, since a number of rather large pieces were dredged from the bottom of the creek for some distance down stream. It includes the contact of the *Delaware* with the underlying formation	20′ ±

(2) Report of the Geological Survey of Ohio, vol. 1, pt. 1, p. 576.

Columbus limestone.

6. Very fossiliferous crystalline gray limestone, the upper surface near the highway bridge showing fine glacial striae ..... 13′
5. Compact brown limestone in massive beds and containing a few fossils in the upper part... 42′

SILURIAN.

Lucas limestone.

4. Compact drab limestone showing a banded structure. These layers are quite massive but weather into much thinner layers. Several fossiliferous horizons occur near the middle of the zone..... 63′
3. Compact drab limestone with some dark gray to brown sandy layers. This zone is brobably the basal portion of the *Lucas limestone* rather than a part of the underlying formation.... 36′

Sylvania sandstone

2. A fine grained friable white sandstone becoming coarser and of a conglomeratic nature in the lower part. The extreme base is made up of limestone pebbles imbedded in the sandstone 43′

Tymochtee formation.

1. Rather thin bedded compact drab limestone exposed at the bottom of the sandstone quarry at Silica but better along the creek to the east and south..... 20′ ±

The line of division between the Silurian and the Devonian is not sharply marked at this place. The change in the character of the depoists from one system to the other is, however, sufficiently great to allow the demarkation of this contact within a few inches or a foot at most. When it is recalled that this is the contact between formations of early or middle Cayugan and upper Ulsterian, it is surprising that the horizon is so ill defined, since it must have been an erosion or weathering surface for a long time. On the Maumee River near Grand Rapids, just across the southern border of Lucas County, the contact is shown and appears as a rather sharp line. Near Columbus, in the central Ohio region, decided evidence of the erosion period which intervened is found in the well developed basal conglomerate of the overlying Columbus limestone.

Along Ten Mile Creek the strata dip to the northwest at an angle which varies frome one to ten degrees. At no place along the creek does the elevation of the strata above drainage exceed eight feet; hence the major part of the section was determined by

measuring the angle of dip at various points, the total width of outcrop, and from this data computing the thickness of the beds. The Delaware, however, was measured more accurately. The Columbus limestone in this section is not essentially different from the same formation as found in other parts of the state. The upper or very fossiliferous portion is perhaps slightly reduced in thickenss and its fauna is somewhat different. This is not so much because of the appearance of new species, but because of the absence of certain characteristic Columbus species, which are so common in central Ohio. The shales and shaly limestones of the Delaware (Traverse), however, present a rather marked contrast to the rock of this formation as it occurs in central or even north central Ohio. In the section under discussion, the fauna is more decidedly Hamilton, there is more shale, and the limestone is even less pure than at localities east of the Cincinnati anticline. A small outcrop of this same shaly limestone occurs along Auglaize River near Junction, Paudling county, where it carries an identical fauna.

There can be no doubt that the Delaware (Traverse) of northwestern Ohio is an integral part of the Hamilton of Michigan and Ontario. It is continuous northward into Monroe county (Michigan) where is has been reported in various well sections[3], and the formation as it occurs farther north, along St. Clair River, is certainly the same. Here it has become much thicker and has lost its cherty layers. At Thedford (Widder) Ontario, this northwestern Delaware fauna occurs in a series of beds[4] which resemble somewhat those that outcrop along Ten Mile Creek.

The following list of species gives some idea of the Devonian fauna in the above section:

TEN MILE CREEK FAUNA.

SPECIES	Columbus	Delaware
Stromatopora granulata Nich		x
Stromatopora ponderosa Nich	x	
Cladopora canadensis Rom		x
Cyathophyllum rugosum H	x	
Cystiphyllum americanum E. and H		x
Diphyphyllum panicum Win		x
Favosites arbuscula H		x
Favosites hamiltoniae H		x
Favosites hemispherica Tr	x	x
Favosites nitella Win		x
Favosites placenta Rom		x
Favosites radiciformis (?) Rom		x
Heliophyllum halli E. and H		x
Streptelasma ungula H		x

(3) Geological Survey of Michigan, vol. VII, pp. 31–33.

(4) Geology of Canada (1863) p. 385.
Also Grabau; Bulletin of the Geological Society of America, vol. XIII, (1902) pp. 150–152.

Species	Columbus	Delaware
Strombodes alpinensis Rom		x
Zaphrentis cornicula (Les.)	x	
Zaphrentis simplex H		x
Dolatocrinus sp		x
Gennaeocrinus (?) *sp*		x
Megistocrinus spinulosis (?) Lyon		x
Cystodictya gilberti (Meek)	x	
Fenestella emaciata (?) H		x
Fistulipora sp		x
Lichenalia sp		x
Orthopora bipinulata (?) (H.)		x
Reteporina striata (?) H		x
Stictoporina plumea (H. and S.)		x
Ambocoelia umbonata Con		x
Atrypa reticularis (Linn.)	x	x
Atrypa spinosa H	x	x
Camarotoechia horsfordi H		x
Centronella ovata H		x
Chonetes arcuatus (?) H	x	
Chonetes coronatus (?) (Con.)		x
Chonetes hemisphericus H	x	
Chonetes lepidus H		x
Chonetes mucronata (?) H		x
Chonetes scitula H		x
Chonetes vicinus (Cast.)		x
Cryptonella planirostris H		x
Cyrtina hamiltonensis H	x	x
Dalmanella lepida (?) H		x
Eunella lincklaeni H		x
Gypidula sp		x
Leiorhynchus laura (Bill.)		x
Nucleospira concinna H	x	x
Pholidostrophia iowaensis (Ow.)	x	x
Productella spinulicosta H	x	
Rhipidomella vanuxemi H	x	x
Schizophoria striatula Schl		x
Spirifer acuminatus (Con.)	x	
Spirifer audaculus (Con.)		x
Spirifer gregarius (Cl.)	x	
Spirifer macrus H	?	x
Spirifer manni H	x	
Spirifer pennatus (Atw.)		x
Spirifer varicosus H	x	
Spirifer sp		x
Stropheodonta concava H		x
Stropheodonta demissa (Con.)	x	x
Stropheodonta hemispherica H	x	
Stropheodonta perplana (Con.)	x	x
Strophonella ampla H	x	
Tropidoleptus carinatus (?) (Con.)		x
Actinopteria boydii H		x
Actinopteria descussata H		x
Aviculopecten sp	x	x
Conocardium cuneus (Con.)	x	
Leioptera dekayi (?) H		x
Limoptera macroptera Con		x
Limoptera pauperata H	x	

Species	Columbus	Delaware
Paracyclas elliptica H.	x	
Pterinea flabellum (Con.)	x	x
Bellerophon cf. *pelops* H.		x
Callonema cf. *bellatula* (H.)		x
Callanema lichas (?) (H.)	x	
Loxonema hamiltoniae H.		x
Pleurotomaria lucina H.	x	
Pleurotomaria sulcomarginata (Con.)		x
Pleurotomaria sp.		x
Trochonema meekanum Miller	x	
Coleolus tennicinctum (?) H.		x
Tentaculites bellulus H.		x
Tentaculites scalariformis H.	x	
Gomphoceras pingue (?) H.		x
Goniatites sp.		x
Orthoceras arkenense Whiteaves		x
Orthoceras sp.	x	
Phacops cristata H.	x	
Phacops rana (Green)		x
Proetus macrocephalus H.		x

Several zones were observed, which carry faunules differing from each other, but available specimens were found to be so much more abundant among the loose rock that most of the collection was made from the material thrown on the bank. On account of this manner of collecting, it is impossible to locate the above species in their exact horizons, but Nos. 8 and 9 of the section carry perhaps three-fourths of the species collected from this formation.

The similarity of these northwestern Delaware beds and their fauna to the Hamilton at Thedford, Ontario, rather than to the same formation east in Ohio is certainly remarkable. This is more evident when we study the coral zone [5] and the layers immediately associated with it. Such close relationship doubtless indicates direct shallow water connection between these Ohio and Canadian sections and the center of dispersion of the Traverse–Hamilton fauna, and, on the other hand, indirect connection between northwestern and central Ohio during the time of their deposition.

(5) Grabau; Loc. cit. pp. 152–159.

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